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(54) Ballast with balancer transformer for fluorescent lamps

(57) The invention relates to a circuit arrangement for igniting and operating at least two discharge lamps, provided with

- input terminals (K1,K2) for connection to a supply voltage source,
- means I (SC, S1, S2) coupled to the input terminals for generating a high-frequency voltage from a supply voltage delivered by the supply voltage source,
- a load branch B coupled to the means I and comprising
  - a first branch A comprising first terminals (K3,K3') for accommodating a discharge lamp and a first inductive element L1,
  - a second branch C shunting the first branch A and comprising further terminals (K4,K4') for accommodating a discharge lamp and a second inductive element L2 which is magnetically coupled to the first inductive element L1, and
- means II for limiting the voltage across branch A and branch C to a first value during the ignition of the discharge lamps.

According to the invention, the circuit arrangement is in addition provided with means III for limting the voltage across branch A and branch C to a second value after the ignition of one of the discharge lamps. The occurrence of ignition voltages of very high amplitude across the discharge lamp igniting last is prevented thereby.

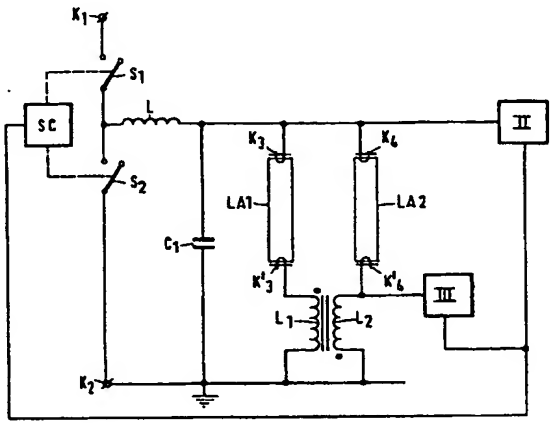

FIG.1

EP 0 766 500 A1

A voltage is present across the inductive elements which differs substantially from zero only in the situation in which one of the discharge lamps is ignited and the other discharge lamp is not. A limitation of the voltage across branch A and branch C may accordingly be realised in a comparatively simple manner when the means III comprise means for limiting the voltage across one of the inductive elements L1 and L2. The means for limiting the voltage across one of the inductive elements will operate exclusively when only one of the discharge lamps is ignited. Since a limitation of the voltage across one of the inductive elements achieves a limitation of the voltage across branches A and C, it is achieved in a simple manner that a limitation of the voltage across branches A and C to the second value is only effected when only one of the discharge lamps is ignited.

Good results were achieved with practical embodiments of a circuit arrangement according to the invention in which the means I comprise a bridge circuit and/or in which the means II are provided with means for controlling the frequency of the high-frequency voltage.

An embodiment of the invention will be explained in more detail with reference to a drawing, in which

Fig. 1 is a diagram of an embodiment of a circuit arrangement according to the invention, with two discharge lamps connected thereto, and
Fig. 2 shows a portion of the circuit arrangement of Fig. 1 in more detail.

In the embodiment shown in Fig. 1, K1 and K2 form input terminals for connection to a supply voltage source. This supply voltage source must deliver a DC voltage in the present case. Switching elements S1 and S2 together with circuit portion SC form means I for generating a high-frequency voltage from the DC voltage. Circuit portion SC forms a trigger circuit for generating a high-frequency control signal for rendering the switching elements S1 and S2 conducting and non-conducting with high frequency. Ballast coil L, capacitor C1, first terminals for accommodating a discharge lamp K3 and K3', further terminals K4 and K4' for accommodating a discharge lamp, and inductive elements L1 and L2 together form a load branch B. Discharge lamp LA1 and discharge lamp LA2 are connected to the first and the further terminals for accommodating a discharge lamp, respectively. Branch A is formed by a series arrangement of terminal K3, discharge lamp LA1, terminal K3', and inductive element L1. Branch C is formed by a series arrangement of terminal K4, discharge lamp LA2, terminal K4', and inductive element L2. The inductive elements L1 and L2 both comprise a number of turns of copper wire around the same magnetizable core. The number of turns of inductive element L1 is equal to the number of turns of inductive element L2, but the winding direction of the turns of inductive element L1 is opposed to that of inductive element L2. The two inductive elements are magnetically coupled to one another via the magnetizable core and together form a balancer transformer. Circuit portion II in this embodiment forms means II for limiting the voltage across branch A and branch C to a first value during the ignition of the discharge lamps. Circuit portion III forms means III for limiting the voltage across branch A and branch C to a second value after the ignition of one of the discharge lamps. The means III in this embodiment are constructed as means for limiting the voltage across inductive element L2.

Input terminals K1 and K2 are interconnected by a series circuit of switching element S1 and switching element S2. Outputs of circuit portion SC are coupled to respective control electrodes of switching element S1 and switching element S2. These couplings are indicated in Fig. 1 with broken lines. Switching element S2 is shunted by a series arrangement of ballast coil L and capacitor C1. Capacitor C1 is shunted by branch A and by branch C. An input of circuit portion II is connected to a common junction point of branch A and ballast coil L. An output of circuit portion II is connected to an input of trigger circuit SC. An input of circuit portion III is connected to a common junction point of inductive element L2 and terminal K4'. An output of circuit portion III is connected to the input of trigger circuit SC.

The operation of the embodiment shown in Fig. 1 is as follows.

When the input terminals K1 and K2 are connected to a supply voltage source, the trigger circuit SC renders the switching elements S1 and S2 alternately conducting and non-conducting with high frequency. A high-frequency voltage is present across branch A and branch C as a result of this. During a first part of the ignition phase, the two discharge lamps have not yet ignited, i.e. immediately after switching-on of the circuit arrangement. The means II limit the voltage across branches A and C to a first value during this first part of the ignition phase. This is done in the present example in that the means II control the frequency of the control signal via the trigger circuit SC such that the voltage across branch A and branch C does not exceed the first value. The ignition of one of the discharge lamps marks the transition from the first part of the ignition phase to a second part of the ignition phase. Assuming discharge lamp LA1 to be ignited, a high-frequency current will flow in inductive element L1 during this second part of the ignition phase, and a high-frequency voltage will be present across inductive element L1. Owing to the magnetic coupling between inductive element L1 and inductive element L2, a high-frequency voltage is also present across inductive element L2, the amplitude of which is substantially equal to the amplitude of the high-frequency voltage across inductive element L1, while the phase is substantially opposed to that of the high-frequency voltage across inductive element L1. This means that the high-frequency voltage across the inductive element L2 is also strongly phase-shifted relative to the high-frequency voltage across branch A and branch C. If the circuit arrangement were not provided

- Input terminals for connection to a supply voltage source,
- means I coupled to the input terminals for generating a high-frequency voltage from a supply voltage delivered by the supply voltage source,
- a load branch B coupled to the means I and comprising

  - a first branch A comprising first terminals for accommodating a discharge lamp and a first inductive element L1,
  - a second branch C shunting the first branch A and comprising further terminals for accommodating a discharge lamp and a second inductive element L2 which is magnetically coupled to the first inductive element L1, and

- means II for limiting the voltage across branch A and branch C to a first value during the ignition of the discharge lamps,
  characterized in that the circuit arrangement is in addition provided with means III for limting the voltage across branch A and branch C to a second value after the ignition of one of the discharge lamps.

2. A circuit arrangement as claimed in Claim 1, wherein the means III comprise means for limiting the voltage across one of the inductive elements L1 and L2.

3. A circuit arrangement as claimed in any one or several of the preceding Claims, wherein the means I comprise a bridge circuit.

4. A circuit arrangement as claimed in any one or several of the preceding Claims, wherein the means II are provided with means for controlling the frequency of the high-frequency voltage.

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EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2596

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE-A-42 43 955 (TRIDONIC) * column 2, line 68 - column 3, line 29; figure 1 *	1,3	H05B41/29
A,D	US-A-4 441 054 (BAY) * column 5, line 3 - column 5, line 24; figure 1 *	1	
A	DE-A-36 26 209 (TELEFUNKEN) * column 5, line 37 - column 6, line 6; figure 1 *	1	
A	EP-A-0 059 064 (THORN) * page 10, line 29 - page 11, line 6; figures 3,5A *	2,4	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) H05B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 February 1996	Speiser, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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